

Higher

GCSE

Combined Science Chemistry A Gateway Science

J250/09: Paper 9 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2023

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS**PREPARATION FOR MARKING****RM ASSESSOR**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. Work crossed out:
- where a candidate crosses out an answer and provides an alternative response, the crossed-out response is not marked and gains no marks
 - if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed-out answer and award marks appropriately.
6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add the annotation SEEN to confirm that the work has been read.
7. There is a NR (No Response) option. Award NR (No Response)
- if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
 - OR if there is a mark (e.g., a dash, a question mark) which isn't an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.















In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response question on this paper is **14**.

11. Annotations available in RM Assessor

| Annotation | Meaning |
|-------------------------------------------------------------------------------------|----------------------------------------|
|  | Correct response |
|  | Incorrect response |
|  | Omission mark |
|  | Benefit of doubt given |
|  | Contradiction |
|  | Rounding error |
|  | Error in number of significant figures |
|  | Error carried forward |
|  | Level 1 |
|  | Level 2 |
|  | Level 3 |
|  | Benefit of doubt not given |
|  | Noted but no credit given |
|  | Ignore |

12. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

| Annotation | Meaning |
|---------------------|---------------------------------------------------------------|
| / | alternative and acceptable answers for the same marking point |
| ✓ | Separates marking points |
| DO NOT ALLOW | Answers which are not worthy of credit |
| IGNORE | Statements which are irrelevant |
| ALLOW | Answers that can be accepted |
| () | Words which are not essential to gain credit |
| — | Underlined words must be present in answer to score a mark |
| ECF | Error carried forward |
| AW | Alternative wording |
| ORA | Or reverse argument |

13. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Chemistry Combined Science A:

| | Assessment Objective |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| AO1 | Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures. |
| AO1.1 | Demonstrate knowledge and understanding of scientific ideas. |
| AO1.2 | Demonstrate knowledge and understanding of scientific techniques and procedures. |
| AO2 | Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures. |
| AO2.1 | Apply knowledge and understanding of scientific ideas. |
| AO2.2 | Apply knowledge and understanding of scientific enquiry, techniques and procedures. |
| AO3 | Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures. |
| AO3.1 | Analyse information and ideas to interpret and evaluate. |
| AO3.1a | Analyse information and ideas to interpret. |
| AO3.1b | Analyse information and ideas to evaluate. |
| AO3.2 | Analyse information and ideas to make judgements and draw conclusions. |
| AO3.2a | Analyse information and ideas to make judgements. |
| AO3.2b | Analyse information and ideas to draw conclusions. |
| AO3.3 | Analyse information and ideas to develop and improve experimental procedures. |
| AO3.3a | Analyse information and ideas to develop experimental procedures. |
| AO3.3b | Analyse information and ideas to improve experimental procedures. |

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For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

| Question | Answer | Marks | AO element | Guidance |
|----------|--------|-------|------------|-----------------------|
| 1 | D | 1 | 2.1 | |
| 2 | B | 1 | 2.2 | |
| 3 | B | 1 | 1.2 | |
| 4 | C | 1 | 1.1 | ALLOW CO ₂ |
| 5 | D | 1 | 2.1 | |
| 6 | C | 1 | 1.2 | |
| 7 | D | 1 | 1.1 | |
| 8 | C | 1 | 2.2 | |
| 9 | B | 1 | 2.2 | |
| 10 | D | 1 | 1.1 | |

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| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|---------------------------------------------------------------------------------------|
| 11 | (a) | Isotopes ✓ | 1 | 1.1 | |
| | (b) | Number of protons = 8 Number of neutrons = 9 Number of electrons = 8 ✓✓ | 2 | 2 x 2.1 | Three correct = 2 marks One or two correct = 1 mark |
| | (c) | 17 ✓ | 1 | 2.1 | ALLOW ECF from 11(b) for incorrectly identified number of protons and neutrons |
| | (d) | Oxygen ✓ | 1 | 2.1 | ALLOW ECF from an incorrect number of protons in 11(b) |
| | (e) (i) | Na = 2.8 ✓ Y = 2.8 ✓ | 2 | 2 x 2.2 | ALLOW any combination of crosses and dots |
| | (ii) | NaY ₂ <input type="checkbox"/> Na ₂ Y <input checked="" type="checkbox"/> Na ₂ Y ₂ <input type="checkbox"/> ✓ | 1 | 2.2 | |
| | (iii) | Atoms of Y and Z have the same number of electrons. <input checked="" type="checkbox"/> Atoms of Y and Z have the same number of neutrons. <input type="checkbox"/> Atoms of Y and Z have the same number of protons. <input type="checkbox"/> ✓ | 1 | 3.1b | |

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| Question | | Answer | Marks | AO element | Guidance |
|----------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-----------------------------------------------------------------|
| | (iv) | <p>Any 3 from:</p> <p>Electrostatic forces (between ions) ✓</p> <p>Attraction between oppositely charged ions / between Na⁺ and Y²⁻ ✓</p> <p>Giant structure / lattice ✓</p> <p>(Electrostatic forces) are strong / require lots of energy to break ✓</p> | 3 | 3 x 1.1 | Maximum 2 marks if incorrect bonding or particles are mentioned |

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| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12 | (a) | <p>Stationary phase = silica gel on a TLC plate ✓</p> <p>Mobile phase = propanone ✓</p> | 2 | 2 x 1.2 | ALLOW solvent for the mobile phase |
| | (b) | <p>The amount of sample used. <input type="checkbox"/></p> <p>The size of the TLC chamber. <input type="checkbox"/></p> <p>The type of solvent used. <input checked="" type="checkbox"/> ✓</p> | 1 | 1.2 | |
| | (c) (i) | <p>First check answer on answer line If answer = 0.32 award 3 marks</p> <p>$R_f = 15 \div 47$ ✓</p> <p>= 0.319 ✓</p> <p>= 0.32 ✓</p> | 3 | 2 x 2.2 1.2 | <p>Maximum 2 marks for any rounding error within the response</p> <p>ALLOW equation quoted correctly in words rather than substitution of numbers</p> <p>ALLOW ECF from incorrect calculation for decimal places mark</p> |
| | (ii) | C ✓ | 1 | 3.2a | |

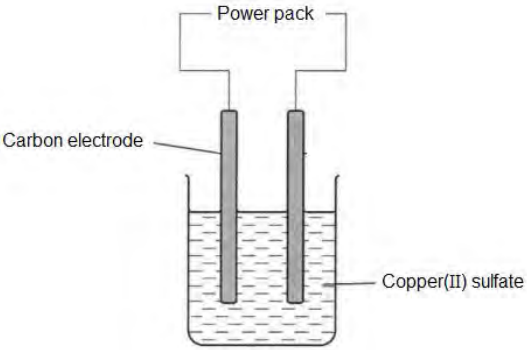
| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 | (a) | <p>Property Idea that graphite is soft / diamond is hard ✓</p> <p>Explanation (Graphite) exists as layers ✓</p> <p>(In graphite) forces between layers are weak / easily broken ✓</p> <p>OR</p> <p>Property idea that graphite conducts electricity / heat ✓</p> <p>Explanation <u>delocalised</u> electrons ✓</p> <p>free to move between the layers / can carry a charge ✓</p> | 3 | 3 x 1.1 | <p>ALLOW ORA Diamond is hard, with the explanation: All 4 covalent bonds are used. Lots of strong bonds would be within the structure</p> |
| | (b) | <p>Property Idea that both have high melting points ✓</p> <p>Explanation Many covalent bonds / giant covalent structure ✓</p> <p>(Covalent bonds) are strong / require a lot of energy to break ✓</p> | 3 | 3 x 1.1 | <p>Maximum 2 marks if incorrect bonding is mentioned IGNORE references to boiling points</p> |

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| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|--------------------------------------------------------------------|
| | (c) | <p>(Models) have (large) gaps between the atoms / size of the atoms are not shown /</p> <p>Bonds shown as solid lines / doesn't show the type of bonding / forces of attraction are not shown /</p> <p>Only shows a limited number of atoms in the molecule / full structure is not shown /</p> <p>Does not show the sharing of electrons / does not show delocalised electrons ✓</p> | 1 | 3.1b | DO NOT ALLOW forces of attraction between molecules or ions |

| Question | Answer | Marks | AO element | Guidance |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14* | <p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Draws a suitable working labelled diagram and describes the electrolysis process and explains how copper can be extracted.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) Draws a suitable labelled diagram and describes the electrolysis process or explains how copper can be extracted OR Describes the electrolysis process and explains how copper can be extracted</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Attempts to draw a labelled diagram OR Describes the electrolysis process OR Explains how copper can be extracted</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p> | 6 | 4 x 2.2 2 x 3.3a | <p>AO2.2 Apply knowledge and understanding of scientific enquiry, techniques and procedures</p> <ul style="list-style-type: none"> • Cu^{2+} and SO_4^{2-} ions are free to move • ions move to oppositely charged electrodes • copper is deposited at the negatively charged electrode / cathode • Cu^{2+} ions are reduced or gain electrons / $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ <p>AO3.3a Analyse information and ideas to develop experimental procedures, e.g.:</p> <ul style="list-style-type: none"> • describes how the apparatus listed would be set up to electrolyse copper sulfate or draws a labelled diagram to show the electrolysis of copper sulfate such as:  |

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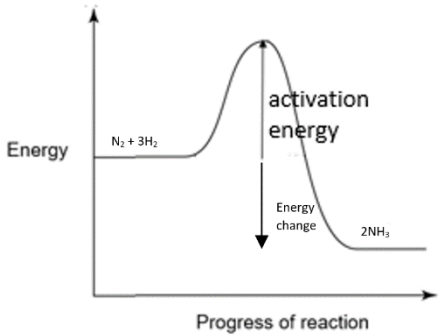
| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15 | (a) | Idea that strong acids have a higher degree of ionisation than weak acids / ORA | 1 | 1.1 | ALLOW dissociates as alternative wording to ionisation |
| | (b) | (i) H^+ ✓ | 1 | 1.1 | |
| | | (ii) (pH meter because) Idea pH meter gives an accurate / specific / numerical reading ✓ Idea that universal indicator relies on interpretation (of colour) ✓ | 2 | 2 x 3.3b | Marks are for explanation |
| | (c) | Idea pH decreases as concentration of hydrochloric acid increases / ORA ✓ Idea pH decreases less at higher concentrations of hydrochloric acid ✓ | 2 | 2 x 3.1a | |
| | (d) | Correct values quoted from the graph ✓ Uses correct values and proves pH increases by 1 as concentration of hydrochloric acid increases by a factor of 10 ✓ | 2 | 2 x 3.1b | Example values that may be quoted: at pH 2 concentration of hydrochloric acid is 0.01 (mol / dm ³) at pH 1 concentration of hydrochloric acid is 0.1 (mol / dm ³) |

| Question | Answer | Marks | AO element | Guidance |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------|--------------------------------------------------------------------------------|
| (e) | <p>First check answer on answer line If answer = 0.11 g award 4 marks</p> <p>Concentration of hydrochloric acid at pH 1.5 = 0.03 (mol / dm³) ✓</p> <p>THEN</p> <p>Mass in 1 dm³ = 0.03 x 36.5 = 1.095 ✓</p> <p>Mass in 100 cm³ = 1.095 ÷ 10 = 0.1095 ✓</p> <p>= 0.11 (g) (2 significant figures) ✓</p> <p>OR</p> <p>Moles in 100 cm³ = 0.03 x 0.100 = 0.003 ✓</p> <p>Mass in 100 cm³ = 0.003 x 36.5 = 0.1095 ✓</p> <p>= 0.11 (g) (2 significant figures) ✓</p> | 4 | <p>3.1a</p> <p>2 x 2.2</p> <p>1.2</p> | <p>ALLOW ECF from incorrect calculation for significant figure mark</p> |

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| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 16 | (a) | (i) | Energy to break bonds = $(945) + (3 \times 435) = 2250$ (kJ / mol) ✓ | 1 | 2.2 | |
| | | (ii) | Energy to make bonds = $6 \times 390 = 2340$ (kJ/mol) ✓ | 1 | 2.2 | |
| | | (iii) | Energy change = $2250 - 2340 = -90$ (kJ / mol) ✓ | 1 | 2.2 | ALLOW ECF from parts (i) and (ii) DO NOT ALLOW 90 /+ 90 unless ECF from parts (i) and (ii) give this as a correct answer |
| | (b) | | Products drawn lower than reactants and labelled $(2)\text{NH}_3$ / products ✓ Curve for reaction profile drawn with activation energy labelled ✓ Energy change labelled ✓  | 3 | 3 x 2.2 | DO NOT ALLOW double headed arrows for either marking point two or marking point three |

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